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Sooner is better: use of a real-time automated bedside dashboard improves sepsis care

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ABSTRACT

Background: Minimizing the interval between diagnosis of sepsis and administration of antibiotics improves patient outcomes. We hypothesized that a commercially available bedside clinical surveillance visualization system (BSV) would hasten antibiotic administration and decrease length of stay (LOS) in surgical intensive care unit (SICU) patients.

Methods: A BSV, integrated with the electronic medical record and displayed at bedside, was implemented in our SICU in July 2016. A visual sepsis screen score (SSS) was added in July 2017. All patients admitted to SICU beds with bedside displays equipped with a BSV were analyzed to determine mean SSS, maximum SSS, time from positive SSS to antibiotic administration, SICU LOS, and mortality.

Results: During the study period, 232 patients were admitted to beds equipped with the clinical surveillance visualization system. Thirty patients demonstrated positive SSS followed by confirmed sepsis (23 Pre-SSS *versus* 7 Post-SSS). Mean and maximum SSS were similar. Time from positive SSS to antibiotic administration was decreased in patients with a visual SSS (55.3 ± 15.5 h *versus* 16.2 ± 9.2 h; $P < 0.05$). ICU and hospital LOS was also decreased ($P < 0.01$).

Conclusions: Implementation of a visual SSS into a BSV led to a decreased time interval between the positive SSS and administration of antibiotics and was associated with shorter SICU and hospital LOS. Integration of a visual decision support system may help providers adhere to Surviving Sepsis Guidelines.

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Introduction

Despite advances in modern critical care, sepsis remains a leading contributor to in-hospital morbidity and mortality. It is estimated that 750,000 patients are treated for severe sepsis and septic shock in the United States each year.[1] Sepsis is a common diagnosis among intensive care unit admissions, and mortality rates have been shown to be at least 25%.[2,3]

The Surviving Sepsis Campaign was launched in 2004 and provided guidelines for the diagnosis and treatment of severe sepsis and septic shock.[4] The Third International Consensus Definitions for Sepsis and Septic Shock defines sepsis as a serious blood infection and associated acute organ dysfunction as outlined by the Sequential Organ Failure Assessment (SOFA) score: vasopressors, mechanical ventilation, elevated creatinine, elevated total bilirubin, thrombocytopenia, and elevated lactate.[5-7] The most recent guidelines were published in 2016 and emphasize early fluid resuscitation, source control, and administration of intravenous antibiotics.[8] Previous studies have shown that optimal outcomes in the treatment of severe sepsis and septic shock are achieved when treatments are administered utilizing clinical care bundles.[9] Unfortunately, widespread implementation and compliance with trauma clinical practice and sepsis treatment bundles is inconsistent.[10-12] In the treatment of sepsis, Seymour *et al.* showed that rapid completion of sepsis treatment bundles was associated with lower in-hospital mortality.[13] Time to antibiotic administration may be the most crucial variable, as further studies have demonstrated increases in mortality with each hour of delay in antibiotic administration.[14]

Clinical decision support tools have the potential to improve treatment of various medical conditions cared for in the intensive care setting.[15-17] Their utility lies in enhancing awareness of worsening and critical disease states to clinicians. Because the treatment of severe sepsis and septic shock is multidisciplinary, clinical decision support tools visible to the patient, patient families, and the entire health care team may augment or expedite the delivery of appropriate, timely medical care. The effect of a visual clinical decision support tool on the time to antibiotic administration in patients with sepsis or potential sepsis is unknown. We hypothesized that implementation of a commercially available bedside clinical surveillance visualization system would be associated with improved patient outcomes, including earlier antibiotic administration, decreased length of stay (LOS), and reduced mortality in surgical intensive care unit (SICU) patients.

Methods

Automated clinical surveillance visualization system

In July 2016, an automated clinical surveillance visualization system (Decisio Health Inc, Houston, TX; www.decisiohealth.com) was implemented within the SICU at the University of Cincinnati Medical Center. This visualization system was integrated with our electronic medical record (EPIC, Verona, WI) and displays patient vital signs and laboratory values in real time on a 42-inch dedicated monitor mounted above the patient's hospital bed (Fig. 1). This visualization system has the ability to integrate with multiple electronic medical records and was initially used with the Cerner EMR (Kansas City, MO). The monitor is visible to physicians and nurses, as well as the patient and family. The patient display is conditionally color-coded to allow for rapid identification of abnormal vital signs and laboratory values. Vital signs and laboratory values within normal clinical ranges are displayed bright green. As the

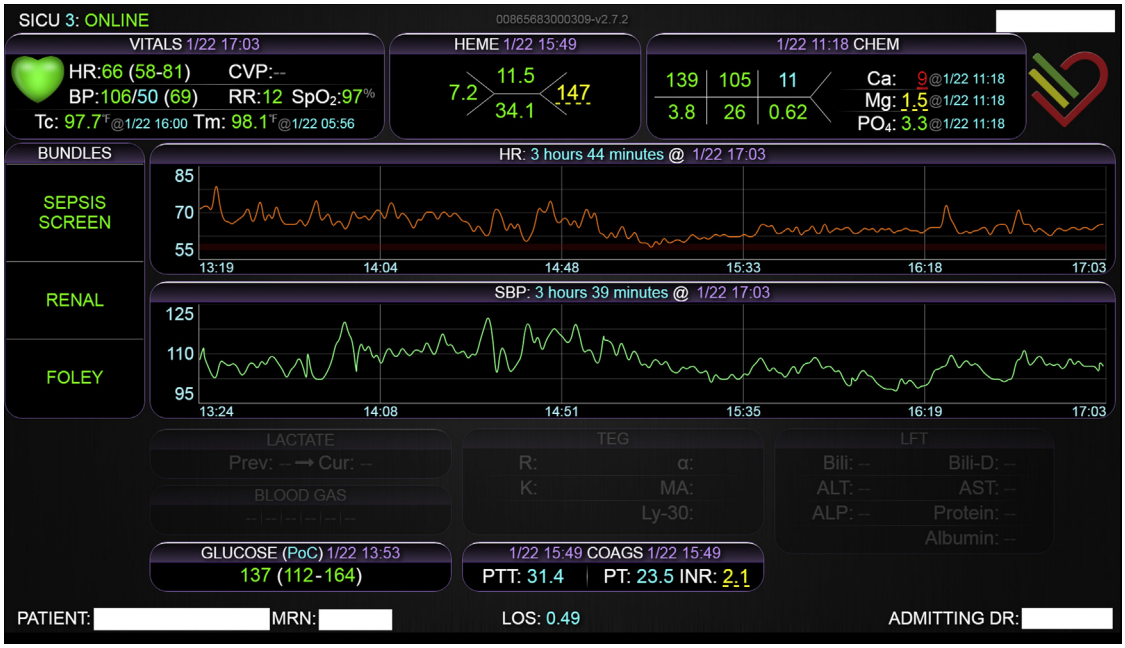

Fig. 1 – An example of the real-time automated clinical surveillance visualization system bedside display for a patient admitted to the surgical intensive care unit. (Color version of figure is available online.)